I-90 Collector/Distributor (C/D) System (part of the Preferred Alternative)

Operation of the I-90 C/D would improve operation of I-90 and arterial streets between the Liberty Park and Sprague Avenue interchanges. The C/D would draw local traffic off mainline I-90 to a separate freeway network, relieving projected congestion problems on mainline I-90 and accommodating local travel demand to and from I-90 in this area (KJS & Associates 1993).

~~If the I-90 C/D is not constructed as part of the proposed project, the resulting traffic congestion along I-90 and at major arterial intersections within the vicinity would likely cause ambient CO levels to increase over those projected assuming operation with the I-90 C/D. CO emissions usually increase as vehicle speeds decrease. While emission rates calculated for 2020 are lower than under existing conditions, the increased number of vehicles operating at congested speeds without the C/D system would likely generate CO in concentrations high enough to cause exceedance of the 8-hour CO standard at receptors in the I-90 vicinity.~~

Mitigation

No adverse impacts are expected; therefore, no mitigation is proposed. Additionally, building the North Spokane Freeway will not delay implementation of any Transportation Control Measures (TCM) or strategies approved by the SRTC Board and adopted by local governing bodies. The proposed preferred alternative incorporates TSM strategies and measures and is recognized under the current congestion management system program.

Noise

Studies and Coordination

Traffic data used for traffic noise modeling was provided by the Spokane Regional Transportation Council (SRTC).

Noise and Noise Standards

Sound travels through the air as waves of minute air pressure fluctuations caused by some type of vibration. Measurements of these fluctuations are reported in a logarithmic decibel (dB) scale. Most sounds consist of a broad range of frequencies. Several frequency weighting schemes have been used to develop composite decibel scales that approximate the way the human ear responds to noise levels. The "A-weighted" decibel scale (dBA) is the most widely used for this purpose. Typical A-weighted noise levels for various types of sound sources are summarized in Table 4-6.

Varying noise levels are often described in terms of the equivalent constant dB level. Equivalent noise levels (Leq) are used to develop single value descriptions of average noise exposure over various periods of time. The Leq data used for these average noise exposure descriptors are generally based on A-weighted sound level measurements.

The nature of dBA scales is such that individual dBA ratings for different noise sources cannot be added directly to give the dBA rating of the combination of the sources. Two noise sources producing equal dBA ratings at a given location will produce a composite noise level 3 dBA greater than either sound alone. When two noise sources differ by 10 dBA, the composite noise level will be only 0.4 dBA

greater than the louder source alone. Most people have difficulty distinguishing the louder of two noise sources if they differ by less than 1.5-2.0 dBA. In general, a 10-dBA increase in noise level is perceived as a doubling in loudness.

Sound waves travel away from the noise source as an expanding spherical surface. The energy contained in a sound wave is consequently spread over an increasing area as it travels away from the source. This results in a decrease in loudness at greater distances from the noise source.

When distance is the only variable factor, sound levels from an isolated noise source will typically decrease by about 6 dBA for every doubling of distance from the noise source. When the noise source is essentially a continuous line (i.e., vehicle traffic on a highway), noise levels decrease by about 3 dBA for every doubling of distance. In traffic noise studies, a drop-off rate of 4.5 dBA per doubling of distance is often used when the roadway is at ground level and the intervening ground is effective in absorbing sound (i.e., ground vegetation, scattered trees, clumps of bushes). When the roadway is elevated, 3.0 dBA per doubling of distance is used, because the sound absorbing effects of the intervening ground are limited.

Sound Source	dBA	Response
Carrier deck jet operation	140	
Limit of amplified speech	130	Painfully loud
Jet takeoff 30 meters (100 feet)	120	Threshold of feeling and pain
Auto horn 1 meter (3 feet)		
Riveting machine	110	
Jet takeoff 600 meters (2,000 feet)		
Shout 0.15 meters (6 inches)	100	Very annoying
New York subway		
Heavy truck 15 meters (50 feet)	90	Hearing damage
Pneumatic drill 15 meters (50 feet)		(8-hour exposure)
Freight train 15 meters (50 feet)	80	Annoying
Garbage disposal in home		
Freeway traffic 15 meters (50 feet)	70	Telephone use difficult
Air conditioning unit 6 meters (20 feet)	60	
Light auto traffic		
Speech in normal voice 4.5 meters (15 feet)	50	Quiet
In-house movement of people, no TV or radio	40	
Soft whisper 4.5 meters (15 feet)	30	Very quiet
Recording studio	20	
	10	Very faint
	0	Threshold of hearing

Typical A-weighted sound levels taken. The "A" scale approximates the frequency response of the human ear.
Source: U.S. Council on Environmental Quality 1970.

Typical Noise Levels
Table 4-6

Freeways are generally considered to have a capacity of 2,000 vehicles per lane per hour. Congestion is described in terms of the ratio between the actual volume of traffic and the capacity. This is referred to as the volume-to-capacity (V/C) ratio. Traffic noise increases with increased volume and speed. As congestion increases (i.e., as the V/C ratio increases), the volume increases but the speed decreases. The net result is that traffic noise reaches a maximum when the V/C ratio is about 0.75,

or LOS C. When the V/C ratio exceeds 0.75, the effect of the reduction in speed is greater than the effect of the increased volume, and noise levels go down. However, as congestion increases, the peak traffic period gets longer. When the V/C ratio exceeds 0.75, peak noise occurs at the beginning and the end of the peak traffic period. Once the V/C ratio exceeds 0.75, the maximum traffic noise level becomes independent of the actual traffic volume and is limited to the noise level generated by traffic operating at LOS C.

Federal Highway Administration (FHWA) and Washington State Department of Transportation Noise Standards

The Federal Noise Control Act of 1972 (Public Law 92-574) requires that all federal agencies administer their programs in a manner that promotes an environment free from noises that may jeopardize public health or welfare.

The FHWA has adopted criteria for evaluating noise impacts associated with federally funded highway projects and determining whether these impacts are sufficient to justify funding noise mitigation actions (47 CFR 131:29653-29656). The FHWA Noise Abatement (mitigation) Criteria (NAC), based on traffic conditions that occur on a regular basis and that yield the worst hourly noise levels, are summarized in Table 4-7.

Activity Category	Leq.Noise Levels (dBA)	Description of Activity Category
A	57	Lands on which serenity and quiet are of
	(exterior)	extraordinary significance and serve an
		important public need, and where the
		preservation of those qualities is essential
		if the area is to continue to serve its intended
		purpose.
B	67	Picnic areas, recreation areas, playgrounds,
	(exterior)	active sports areas, parks, residences, motels,
		hotels, schools, churches, libraries, and
		hospitals.
C	72	Developed lands, properties, or activities not
	(exterior)	included in categories A or B above.
D		Undeveloped lands.
E	52	Residences, motels, hotels, public meeting
	(interior)	rooms, schools, churches, libraries, hospitals,
		and auditoriums.

Source: U.S. Department of Transportation 1982

Federal Highway Administration (FHWA) Noise Abatement Criteria (NAC)

Table 4-7

Definition of a Traffic Noise Impact

~~As defined in 23 CFR 772, a noise impact occurs when a predicted traffic noise level approaches or exceeds (AOE) the NAC listed in Table 4-7 or when the predicted traffic noise level substantially exceeds the existing noise level. As defined by WSDOT, a noise level within 2 dBA of the NAC is considered to~~

~~approach the NAC, a noise level greater than or equal to the NAC is considered to exceed the NAC, and a 10-dBA increase is considered to be a substantial increase.~~

Impacts which occur when the predicted traffic noise levels approach or exceed the noise abatement criteria (Table 4-7), or when the predicted traffic noise levels substantially exceed the existing noise levels are defined as noise impacts under section 23 CFR 772. As defined by WSDOT, a noise level within 2 dBA of the NAC is considered to approach the NAC, a noise level greater than or equal to the NAC is considered to exceed the NAC, and a 10-dBA increase is considered to be a substantial increase.

Local Noise Regulations and Ordinances

The city of Spokane and Spokane County do not have land use compatibility guidelines for noise. Both the city and the county have adopted local noise - ordinances.

The project alternative alignments are in both incorporated and unincorporated areas of Spokane County. The city of Spokane noise ordinance would apply inside the city limits; the Spokane County noise ordinance would apply in the unincorporated parts of the county.

The city of Spokane noise ordinance states:

> "No person may make or permit any unnecessary or unusual noise between the hours of 6 a.m. and 10 p.m. to the annoyance of others. No person may make or permit, in the operation of a machine, a noise between the hours of 10 p.m. and 6 a.m. to the annoyance of any other person of ordinary sensibilities."

The ordinance can be interpreted to mean that if construction noise does not result in annoyance (i.e., complaints), construction can occur 24 hours per day. However, if construction noise does result in complaints, construction may not be allowed between 10 p.m. and 6 a.m.

The Spokane County code similarly states that it is unlawful for any person to cause any sound that creates a disturbance. However, sounds resulting from public works projects or public works maintenance operations executed at the expense of the federal government, state, or municipality are exempt from the noise provisions of the code. Sounds resulting from construction activity at temporary construction sites are also exempt from the noise provisions of the code between 7 a.m. and 10 p.m. or when the construction activity is conducted more than 300 meters (1,000 feet) from any occupied residence.

Method of Analysis

Noise monitoring was conducted in the project area to quantify existing noise conditions. Because the proposed project is a freeway, emphasis was placed on noise from traffic sources. No attempt was made to specifically quantify noise from rail or aircraft sources.

This study has been prepared in accordance with Title 23 Code of Federal Regulations, Chapter 1, Subsection 772 (23 CFR 772). The following method was used:

1. Identify existing activities, developed lands, and undeveloped lands for which development is planned, designed, or programmed and that may be affected by noise from the proposed highway.
2. Determine typical existing traffic noise levels by measurement at selected representative locations.
3. Predict traffic noise levels using the Federal Highway Administration (FHWA) Traffic Noise Prediction Model (FHWA-RD-77-108).
4. Identify traffic noise impacts using the relative and absolute criteria specified in 23 CFR 772.
5. Identify noise mitigation measures for reducing or eliminating noise impacts, giving weight to the benefits and costs of mitigation.
6. If no impacts are found to exist, briefly explain the basis for this conclusion. If impacts do exist, determine if there are any reasonable and feasible mitigation measures.

Because the project would extend over a large area, segments of freeway were analyzed separately. The design year is taken to be 2020. For each freeway segment analyzed, each lane of traffic was individually delineated in the model. Both I-90 and the proposed freeway have three primary roadway types: elevated, at grade, and depressed. For elevated segments, the shielding effects of the roadway surface and a standard Jersey barrier were included in the model. Transition zones between each elevated, at-grade, and depressed segment were analyzed, as were the effects of roadway curvature and traffic on ramps. An attenuation rate of 3 dBA per doubling of distance was used for elevated segments. An attenuation rate of 4.5 dBA per doubling of distance was used for at-grade and depressed segments.

Traffic volume and speed data used as input to the FHWA traffic noise prediction model were developed by SRTC. The FHWA noise model requires that assumptions about the percentage of automobiles (two-axle, four-tire vehicles), medium trucks (two-axle, six-tire vehicles), and heavy trucks (three or more axles) be made. The mixes of automobiles, medium-duty trucks, and heavy-duty trucks for various types of roadways were estimated from data provided by SRTC and WSDOT (Washington State Department of Transportation 1991) and are summarized in Table 4-8. Traffic noise levels were predicted using a spreadsheet implementation of the FHWA noise model and the STAMINA 2.0 computer model (Bowlby et al. 1982).

Roadway Type	Autos	Medium Trucks	Heavy Trucks
Minor Arterial	97.5%	2.0%	0.5%
Major Arterial	92.4%	5.1%	2.5%
Freeway	87.3%	7.6%	5.1%
Ramps	96.2%	3.0%	0.8%

Vehicle Mix Used in Noise Analysis
Table 4-8

The effects of local structures acting as noise shields have been included in the model to provide a higher level of detail and accuracy in accordance with FHWA guidelines. Local shielding has a substantial effect on reducing the noise and thus reducing the area of impact. A first row of houses (along the freeway) that provides 40-65 percent shielding reduces noise impacts to the second row of houses by 3 dBA. A first row of houses that provides 65-90 percent shielding reduces noise to second row houses by 5 dBA. Each successive row of houses provides an additional 1.5 dBA of shielding, to a maximum allowable of 10 dBA. In the model, the initial attenuation of 3 dBA was employed to reflect typical conditions in the area.

Other Possible Sources of Noise

Rail related activities are a principal but relatively intermittent source of noise in the area. A Burlington Northern Railroad switching yard is located in the area roughly bounded by Francis Avenue, Ferrall Street, Wellesley Avenue, and Market Street. Another Burlington Northern Railroad yard and a Union Pacific Railroad yard are located at the south end of the project near I-90. Burlington Northern Railroad tracks run parallel to the North Option and the Market/Greene corridor approximately between Stoneman Road and Buckeye Avenue.

Felts Field Airport is southeast of the project area between Havana Street and Bowman Road. Spokane International Airport is approximately 13 to 18 kilometers (8 to 11 miles) southwest of the project area. Fairchild Air Force Base is approximately 19 to 24 kilometers (12 to 15 miles) southwest of the project area. Aircraft associated with these facilities routinely fly over the project study area.

Identification of Land Use, Buildings, and Individuals Affected

A wide variety of land uses are located adjacent to the proposed freeway alignments, as discussed below.

Market/Greene Alternative (Preferred Alternative)

The route from I-90 to First Avenue passes through a single family residential area. The area from First Avenue to Mission Avenue is characterized by industrial firms and other business properties. North of Mission Avenue and south of the Spokane River, the route crosses the Spokane Community College campus. A single family residential neighborhood lies west of Greene Street and the campus. North of the river to Grace Street, both multi and single family residences are adjacent to the alignment. Light industrial, retail, and service uses are located to the west, between the alignment and Market Street. The area north of Grace Street to Empire on the east is single-family residential. On the west from Grace to Empire and north of Empire to Francis Avenue are small businesses, scattered industry, and vacant land.

North of Francis Avenue, the alignment passes through or near vacant land, a small portion of a low density single family residential area, and east of the North Market Street Superfund Site.

Havana Alternative

The route from I-90 to First Avenue passes through a single family residential area. The area from First Avenue to the Spokane River is characterized by industrial firms and other business properties. North of the river to Euclid Avenue, single family residences are adjacent to the alignment on the west. On the east are a power substation and low density light industrial uses. North of Euclid Avenue to Rich Avenue, the route passes through Minnehaha Park and the Esmeralda Golf Course. North of the Esmeralda Golf Course, the route enters the eastern portion of the Hillyard Neighborhood, with scattered houses on urban sized lots between the golf course and Wellesley Avenue. From Wellesley Avenue to Francis Avenue, the route passes through vacant land and a light industrial area. North of Francis Avenue, the route passes vacant land, a small portion of a low density single family residential area near Lincoln Road, and east of the North Market Street Superfund Site.

North Option (Preferred Alternative)

For the link to the Market/Greene route, the North Option begins south of Lincoln Road; for the link to the Havana route, it begins north of Regal Street/Freya Street. In both cases, the area is industrial. North to Parksmith Road, the land is mostly vacant or used for salvage yards. From Coxe Road to US 2, the route passes through undeveloped land and adjacent to the west corner of a mobile home residential area. From US 2 to US 395, the route passes through some undeveloped land but mostly through low density residential development. North of US 395, the route passes through undeveloped land.

South Option

For the Market/Greene route, the South Option begins in the Burlington Northern Railroad yard area south of Lincoln Road; for the Havana route, it begins north of the North Market Street Superfund Site. This area is characterized by light industrial and commercial uses. From Magnesium Road to Hawthorne Road, the route crosses predominantly vacant industrial land. From Hawthorne Road to US 2, the route passes through mostly undeveloped land. Single family residential development is located on both sides of the route from US 2 to US 395; the route then crosses the eastern portion of Pine Acres golf course before crossing US 395. North of US 395, there is scattered residential land use and commercial development.

I-90 Collector/Distribution (C/D) System (part of the Preferred Alternative)

The I-90 C/D system runs along the north and south sides of I-90 between the Liberty Park Interchange and Sprague Avenue Interchange. Single family residential land uses are located on both sides of I-90 for the entire length of the C/D system.

Test Position and Number		Land Use	Start Date	Start Time	Interval Leq.
1	Mead Mobile Home Park	residential	11-18-91	12:35 p.m.	55
2	60 feet from Farwell Road near Farwell School	residential	11-18-91	1:15 p.m.	67 (a)
3	50 feet from Hastings Road near shopping center	residential	11-18-91	1:40 p.m.	67
4	End of Guinevere Street	residential	11-18-91	2:16 p.m.	48
5	Near College Street and Middleton Street	residential	11-18-91	2:57 p.m.	45
6	Fairwood Church on Farwell Road	church	11-18-91	3:25 p.m.	58
7	Perry Street north of Farwell Road	residential	11-18-91	3:46 p.m.	61
8	Near Farwell Road and Mayfair Street	residential	11-18-91	4:04 p.m.	60
9	Pacific Ave. between Havana St. and Florida St.	residential	11-19-91	7:26 am	62
10	2nd Avenue between Greene Street and Ray Street	residential	11-19-91	7:53 am	76
11	Northeast corner of Ray Street and Pacific Street	residential	11-19-91	8:04 am	57
12	Southwest corner of Ray Street and 1st Avenue	residential	11-19-91	8:10 am	54
13	Northeast corner of Havana Street and 2nd Avenue	residential	11-19-91	8:16 am	64
14	2nd Ave. between Havana St. and Dearborn St.	residential	11-19-91	8:26 am	63
15	3rd Ave. between Myrtle St. and Rebecca St.	residential	11-19-91	8:58 am	69
16	Office between Freya Way and Thor Street	office	11-19-91	9:05 am	64
17	Northeast Corner of Ermina Ave. and Fiske St.	residential	11-19-91	9:25 am	58
18	Mary Queen Church	church	11-19-91	9:39 am	51
19	Northeast corner of Haven St. and Liberty Ave.	residential	11-19-91	10:00 am	58
20	Southeast corner of Liberty Avenue and Thor Street	residential	11-19-91	10:10 am	52
21	Northwest corner of Euclid Ave. and Havana St.	residential	11-19-91	10:20 am	54
22	Empire Street near Wildhorse Park	residential	11-19-91	10:30 am	50
23	Southeast corner of Rich Avenue and Myrtle Street	residential	11-19-91	10:40 am	61
24	Southeast corner of Regal St. and Wellesley Ave.	residential	11-19-91	10:50 am	49
25	Regal School	school	11-19-91	11:08 am	49
26	Southwest corner of Regal Street and Queen Street	church	11-19-91	11:23 am	50
27	Hillyard Pool/Playground	park	11-19-91	11:42 am	63
28	Mt. St. Michael	park	11-19-91	12:15 p.m.	49
29	Near Lincoln Road and Julia Street	residential	11-19-91	12:25 p.m.	49
30	Morgan Acres Community Church	church	11-19-91	12:43 p.m.	49
31	Harmon Playfield	park	11-19-91	1:07 p.m.	66
32	Libby Center ~~Middle School~~*	school	9-13-91	8:53 am	68
33	Sheridan School	school	9-13-91	9:23 am	65
34	Spokane Community College (b)	school	9-13-91	10:03 am	74
35	Cooper School	school	9-13-91	10:23 am	68 (b)
36	Mattes Residence	residential	9-11-91	6:05 p.m.	63 (a)
37	McKay Residence	residential	9-11-91	5:40 p.m.	55 (a)

(a)Site was monitored for 24 hours using full one-hour Leq increments. Level represents maximum values that occurred during the 24 hours.
(b)High noise levels are attributed to wind.
*~~Libby Middle School was closed as a school after the 1993-94 school year.~~

Summary of Noise Monitoring Results
Table 4-9

Determination of Significant Terrain Features That Affect Noise

The topography along the proposed routes rises gently from I-90 to Trent Avenue, then drops down to the Spokane River. North of the river, the ground rises more sharply to a peak at Wellesley Avenue and gradually drops to the north to the end of the project. The variations in topography are considered gradual enough that flat terrain can be assumed in the noise model. The Havana Alternative would require a substantial cut through the west edge of Beacon Hill. A substantial cut would also be required for both alternatives on the west edge of the slope at the merge point of the two alternatives (vicinity of Lincoln Road). These cuts would limit noise propagation to the east. Terrain features are considered in the model.

Impacts

(For discussion of construction activity impacts, see the Construction Activity Impacts section of this EIS.)

Existing Noise Level

Traffic on roadways is the predominant source of noise in the project area. Primary sources of such noise include traffic on I-90, US 395, US 2 (Division Street), Sprague Avenue, Trent Avenue (US 290), Mission Avenue, Euclid Avenue, Wellesley Avenue, Francis Avenue, Freya Way, Market/Greene Street, and Farwell Road.

Measurements were taken at locations considered to be representative of sensitive receptors in the project area (see Table 4-9). (Map locations are shown in Figures 4-2 through 4-4). Monitoring was conducted for approximately 10 minutes at each location. Locations 2, 36, and 37 were monitored for 24 hours using full one hour Leq increments. The levels shown in Table 4-9 for these sites represent the maximum Leq levels that occurred during the 24 hours. During this noise monitoring, the weather was generally sunny with light winds from the south.

The North Spokane Freeway is a new alignment. Since there is no existing state highway, the ambient noise levels measured along the corridor were used to determine existing impacts and whether predicted noise levels for the design year would substantially exceed existing levels. A comparison of predicted noise levels for areas near the proposed I-90 interchange with those measured is shown in Table 4-10. Measured noise levels were within 2 dBA of predicted values for all compared sites.

Site	Location	Highway Type	Noise Measured	Level Predicted
10	90 m (300 feet) N of I-90 at C/D	AG	76	74
13	90 m (300 feet) NE of I-90 at C/D	EV	64	65
14	180 m (600 feet) NE of I-90 at C/D	EV	63	62
15	90 m (300 feet) NE of I-90 at C/D	EV	69	68
33	120 m (400 feet) SE of I-90 at C/D	EV	65	64
EV = Elevated AG = At-Grade				

Comparison of Predicted Noise with Measured Noise Levels
Table 4-10

The No-Build Alternative

Noise levels for the no-build alternative would not change dramatically from the existing conditions. Increased traffic in the area near I-90 may result in an imperceptible 1 to 2 dBA increase in noise levels. On most arterials, traffic volumes on surface streets will continue to grow. Traffic volumes are not expected to increase by more than a factor of two, resulting in a maximum increase in noise levels of 3 dBA. On a few major arterials (Broadway, Crestline Street, Hastings Road, Hawthorne Road, Market/Greene Street, Sprague Avenue, and Trent Avenue), volumes may increase by as much as a factor of four. However, due to the current level-of-service of these streets, noise from the increased volumes will be countered by the decreased speed resulting from greater congestion. Noise levels are not expected to increase by more than 4 dBA.

The "Build" Alternatives

Tables 4-11 and 4-12 summarize the results of the noise impact analysis for each NSF route; Table 4-13 summarizes results for the I-90 C/D. The analysis covers the segments within each route, the type of roadway, and the distance to the (67 dBA) impact limits for both sides of the roadway. The number of residences impacted by either excessive traffic noise or a substantial increase in traffic noise is identified, along with other impacted sensitive receptors (parks, schools, etc.).

The Market/Greene Alternative with South Option would result in approximately 215 impacts, 200 from noise levels that approach or exceed the NAC and 15 from noise levels that would increase substantially over existing conditions. Spokane Community College is directly adjacent to the alignment. Because of the shielding provided by the buildings, no outside or interior impacts are predicted for the - Spokane Community College campus. Sections of Wildhorse Park and Pine Acres Golf Course would be impacted.

The Market/Greene Alternative with North Option would result in approximately 220 impacts, 210 from noise levels that approach or exceed the NAC and 10 from noise levels that would substantially increase over existing conditions. Sections of Wildhorse Park would also be impacted.

The Havana Alternative with South Option would result in approximately 170 impacts, 125 from noise levels that approach or exceed the NAC and 45 from noise levels that would substantially increase over existing conditions. Sections of Minnehaha Park, and Esmeralda and Pine Acres Golf Courses, would also be impacted.

The Havana Alternative with North Option would result in approximately 175 impacts, 135 from noise levels that approach or exceed the NAC and 40 from noise levels that would substantially increase over existing conditions. Sections of Minnehaha Park and Esmeralda Golf Course would also be impacted.

The I-90 C/D would result in approximately 485 impacts because of noise levels that approach or exceed the NAC. Noise levels will not substantially exceed the existing conditions around I-90, since noise levels in this area are already high

Freeway Segment	Road Type(1)	Distance to 67 dBA-Leq Contour Line (2,3) meters (feet)		Distance to 72 dBA-Leq Contour Line (2,3) meters (feet)	
		West Side	East Side	West Side	East Side
Market/Greene With South Option					
I-90 to Trent-Mission interchange	EV	90 (300)	90 (300)	Within ROW	Within ROW
Trent-Mission interchange to Grace St.	EV	90 (300)	90 (300)	N/A	N/A
Grace Street to Garland Avenue	DP	75 (250)	75(250)	N/A	N/A
Garland Avenue to Wellesley Avenue	DP	75 (250)	150+ (500+)	Within ROW	N/A
Wellesley Avenue to Francis Avenue	DP	60 (200)	60 (200)	Within ROW	Within ROW
Francis Avenue to Lincoln Road	DP	105 (350)	105 (350)	N/A	N/A
Lincoln Road to US 2	EV	105 (350)	105 (350)	Within ROW	Within ROW
US 2 to US 395	EV	75 (250)	75 (250)	N/A	N/A
North of US 395	EV	75 (250)	75 (250)	N/A	N/A
Market/Greene North Option					
I-90 to Trent-Mission interchange	EV	90 (300)	90 (300)	Within ROW	Within ROW
Trent-Mission interchange to Grace St.	EV	90 (300)	90 (300)	N/A	N/A
Grace Street to Garland Avenue	DP	75 (250)	150+ (500+)	N/A	N/A
Garland Avenue to Wellesley Avenue	DP	75 (250)	75 (250)	Within ROW	75 (250)
Wellesley Avenue to Francis Avenue	DP	60 (200)	60 (200)	Within ROW	Within ROW
Francis to Lincoln Road	DP	105 (350)	105 (350)	N/A	N/A
Lincoln Road to Stoneman Road	EV	105(350)	105(350)	Within ROW	Within ROW
Stoneman Road to US 2	AG	120 (350)	105 (350)	N/A	N/A
US 2 to US 395	EV	75 (250)	75 (250)	N/A	N/A
North of US 395	EV	90 (300)	90 (300)	N/A	N/A
Havana With South Option					
I-90 to Trent-Mission Interchange	EV	90 (300)	90 (300)	Within ROW	Within ROW
Trent-Mission Interchange to Montgomery	EV	90 (300)	150+ (500+)	75 (250)	75 (250)
Montgomery to Euclid	EV	90 (300)	150+ (500+)	N/A	75 (250)
Euclid to Esmeralda Golf Course	DP	75 (250)	75 (250)	N/A	N/A
Esmeralda Golf Course to Wellesley Avenue	AG	90 (300)	140 (450)	N/A	N/A
Wellesley Avenue to Francis Avenue	AG	90 (300)	140 (450)	Within ROW	Within ROW
Francis to Lincoln Road	EV	105 (350)	105 (350)	Within ROW	Within ROW
Lincoln Road to US 2	EV	105 (350)	105 (350)	Within ROW	Within ROW
US 2 to US 395	EV	75 (250)	75 (250)	N/A	N/A
North of US 395	EV	75 (250)	75 (250)	N/A	N/A
Havana With North Option					
I-90 to Trent-Mission Interchange	EV	75 (250)	75 (250)	Within ROW	Within ROW
Trent-Mission Interchange to Montgomery	EV	90 (300)	150+ (500+)	75 (250)	75 (250)
Montgomery to Euclid	EV	90 (300)	150+ (500+)	N/A	75 (250)
Euclid to Esmeralda Golf Course	DP	75 (250)	75 (250)	N/A	N/A
Esmeralda Golf Course to Wellesley	AG	90 (300)	140 (450)	N/A	N/A
Wellesley Avenue to Francis Avenue	AG	90 (300)	140 (450)	Within ROW	Within ROW
Francis to Lincoln Road	EV	135 (450)	105 (350)	Within ROW	Within ROW
Lincoln Road to Stoneman Road	EV	105 (350)	105 (350)	Within ROW	Within ROW
Stoneman Road to US 2	AG	120 (350)	105 (350)	N/A	N/A
US 2 to US 395	EV	75 (250)	75 (250)	N/A	N/A
North of US 395	EV	90 (300)	75 (250)	N/A	N/A

NOTES:
(1) Roadway Types: AG = At-Grade Roadway, EV = Elevated Viaduct, DP = Depressed Roadway.
(2) All distances are measured from the centerline of the roadway.
(3) Noise levels in transitional areas near the borders of each segment may be interpolated.
N/A = Not Applicable to adjacent land use ROW = Right Of Way

Summary of Noise Analysis For NSF for Design Year (2020)
Table 4-11

Freeway Segment	Road Type(1)	AOE	Impacted Residences West/East SI	Total	Other Sensitive Receivers Impacted
Market/Greene South Option	**TOTAL>**	75 /125	5 / 10	215	
I-90 to Trent-Mission interchange	EV	0 / 0	0 / 0	0	
Trent-Mission interchange to Grace St.	EV	60 / 40	0 / 0	100	
Grace Street to Wellesley Avenue	DP	0 / 60	0 / 0	60	Wildhorse Park
Wellesley Avenue to Francis Avenue	DP	0 / 0	0 / 0	0	
Francis Avenue to Lincoln Road	DP	5 / 15	0 / 5	25	
Lincoln Road to US 2	EV	0 / 0	0 / 0	0	
US 2 to US 395	EV	10 / 10	5 / 5	30	Pine Acres Golf Course
North of US 395	EV	0 / 0	0 / 0	0	
Market/Greene North Option	**TOTAL>**	75 /125	5 / 5	210	
I-90 to Trent-Mission interchange	EV	0 / 0	0 / 0	0	
Trent-Mission interchange to Grace St.	EV	60 / 40	0 / 0	100	
Grace Street to Wellesley Avenue	DP	0 / 60	0 / 0	60	Wildhorse Park
Wellesley Avenue to Francis Avenue	DP	0 / 0	0 / 0	0	
Francis to Lincoln Road	AG	5 / 15	0 / 5	25	
Lincoln Road to Stoneman Road	EV	0 / 0	0 / 0	0	
Stoneman Road to US 2	AG	0 / 10	0 / 0	10	
US 2 to US 395	EV	10 / 0	5 / 0	15	
North of US 395	EV	0 / 0	0 / 0	0	
Havana With South Option	**TOTAL>**	**90 / 35**	**30 / 15**	**170**	
I-90 to Trent-Mission interchange	EV	0 / 0	0 / 0	0	
Trent-Mission interchange to Euclid	EV	70 / 0	20 / 0	90	
Euclid to Esmeralda Golf Course	DP	0 / 0	0 / 0	0	Minnehaha Park
Esmeralda Golf Course to Wellesley Ave.	AG	5 / 10	5 / 5	25	
Wellesley Avenue to Francis Avenue	AG	0 / 0	0 / 0	0	
Francis to Lincoln Road	EV	5 / 15	0 / 5	25	
Lincoln Road to US 2	EV	0 / 0	0 / 0	0	
US 2 to US 395	EV	10 / 10	5 / 5	30	Pine Acres Golf Course
North of US 395	EV	0 / 0	0 / 0	0	
Havana With North Option	**TOTAL>**	**90 / 35**	**30 / 10**	**165**	
I-90 to Trent-Mission interchange	EV	0 / 0	0 / 0	0	
Trent-Mission interchange to Euclid	EV	70 / 0	20 / 0	90	
Euclid to Esmeralda Golf Course	DP	0 / 0	0 / 0	0	Minnehaha Park
Esmeralda Golf Course to Wellesley Ave.	AG	5 / 10	5 / 5	25	
Wellesley Avenue to Francis Avenue	AG	0 / 0	0 / 0	0	
Francis to Lincoln Road	EV	5 / 15	0 / 5	25	
Lincoln Road to Stoneman Road	EV	0 / 0	0 / 0	0	
Stoneman Road to US 2	AG	0 / 10	0 / 0	10	
US 2 to US 395	EV	10 / 0	5 / 0	15	
North of US 395	EV	0 / 0	0 / 0	0	

NOTES: Roadway Types: AG = At-Grade Roadway, EV = Elevated Viaduct, DP = Depressed Roadway, AOE = Approaches or Exceeds the NAC, and SI = Substantial Increase of 10 dBA or greater.

Summary of Noise Analysis for NSF for Design Year (2020)

Table 4-12

I-90 C/D Segment	Road Type(1)	Leq North and South Sides in meters (ft.)(2,3,4,6)	Number of Residences Impacted by AOE(5) South/North	Other Sensitive Receivers Impacted
Liberty Park, south of I-90 from				
Perry Street to Pittsburgh Street	EVB and AG	150+ (500+)	N/A	Liberty Park
Perry Street to Altamont Street	EVB and AG	105 to 120 (350 to 400)	75 / 35	East Side Youth Center
Altamont Street to Regal Street	AG and EVB	105 to 120 (350 to 400)	44 / 40	Libby Center *
Your Place Park				
Regal Street to Rebecca Street	AG and DP	75 to 105 (250 to 350)	35 / 66	Sheridan School
Rebecca Street to Florida Street	AG and DP	75 to 105 (250 to 350)	35 / 40	
Florida Street to Fancher Road	AG and EVB	105 to 120 (350 to 400)	55 / 65	
		TOTAL	485	

NOTES:
(1) Roadway Types: AG = At-Grade roadway, EVB = Elevated Berm, DP = Depressed Roadway
(2) All distances are measured from the centerline of the roadway
(3) Varies depending on roadway elevation
(4) Noise levels in transitional areas near the borders of each segment may be interpolated
(5) No areas are anticipated to experience an increase in noise of 10 dBA or more
(6) N/A = Not Applicable to the adjoining land use *~~Libby Middle School was closed as a school after the 1993-94 school year.~~

Summary of I-90 and I-90 Collector/Distributor Noise Analysis Results for Design Year (2020)

Table 4-13

Mitigation

In accordance with the Code of Federal Regulations (23 CFR Chapter 1, Part 772), the following noise mitigation measures were considered on this project to reduce traffic noise impacts when applicable:

- Traffic management measures
- Alteration (during final design) of horizontal and vertical alignments where feasible
- Construction of noise barriers
- Acquisition of real property or interests therein, to serve as a buffer zone and preempt development that would be adversely impacted by traffic
- Noise insulation of public use or nonprofit institutional structures

In cases where severe traffic noise impacts are expected and the mitigation - measures listed above are unfeasible or economically unreasonable, measures other than those listed may be proposed by the highway agency.

A number of factors go into determining whether mitigation is reasonable and feasible, including:

- Noise mitigation benefits
- Cost of mitigation
- Views from impacted residences
- Absolute noise levels
- Changes in noise levels
- Development along the highway
- Environmental effects of mitigation construction

These factors are used in a lengthy process to determine the most cost effective way to reduce noise levels. Absolute noise levels and predicted changes in noise levels are found through Traffic Noise Prediction Model which in turn is used to determine impacts within an affected area. Mitigation cost is then compared to the number and types of developments affected. The cost to benefit comparisons are then completed including respect to visual impacts. This process can require several iterations before a noise abatement plan is developed.

Traffic management mitigation measures would have little benefit for a freeway project such as this, because the overall effect on noise from the reduced volume of traffic on the freeway would be small. Alteration of horizontal and vertical alignments has limited applicability, but is discussed where appropriate.

Sound wall cost is estimated using $130 per square meter ($12 per square foot) for sound walls built at the edge of the right of way and $160 per square meter ($15 per square foot) for sound walls built at the edge of the shoulder (personal communication with Ernest W. Combs, Washington State Department of Transportation, April 1993). The increased cost for construction at the shoulder results from including a safety barrier at the bottom of the wall. An estimate of $160 per square meter ($15 per square foot) is used for sound walls built on an elevated viaduct.

WSDOT uses several criteria to assess the feasibility and reasonableness of noise walls. For a noise wall to be considered feasible, it must be buildable and must provide a minimum of 7 dBA reduction for the first row of receivers. "Reasonableness" involves factors such as cost, benefit, public opinion, and noise reduction. Cost, benefit, and reduction criteria are summarized as follows:

- The barrier should provide a reduction of 7-10 dBA for the first row of receivers.
- A reasonable cost benefit is $10,500 per house receiving at least a 3 dBA reduction in noise level. Residences do not have to be impacted to be considered in the cost benefit calculation.

During the design stage public opinion may affect the final decision on type of barrier selected to mitigate noise. Mitigation of noise was a major topic at most public meetings. A reduction in noise level was felt to be highly desirable but not at the complete expense of visual quality. The proposal to mitigate noise with walls or berms was well received by the neighborhood groups as long as the location and architectural/landscaping was incorporated with them.

Mitigation was considered for all areas impacted by noise. However, a detailed investigation was not conducted for areas where housing is extremely scattered. The cost per residence in such areas is extremely high and considered unreasonable for the estimated future noise levels. Where barriers are constructed on both sides of the freeway, they may be covered by a sound absorbing material to reduce reflected noise caused by the tunnel-like geometry.

~~The effectiveness of the proposed mitigation is shown in Tables 4-14 and 4-15. Wall heights of 3.6 to 5 meters (12 to 16 feet) were investigated. Results are shown for the wall heights that would provide the required 7 dBA reduction and reduce noise levels below the AOE (approaches or exceeds the NAC found in Table 4-7)~~

~~criteria with three exceptions. One of these is along the North Spokane Freeway, where a 7 dBA reduction would not be obtainable with a wall of reasonable height. A wall height of 3.6 meters (12 feet) was considered because the resulting barrier would provide the 7 dBA decrease required to be considered feasible and reduce noise levels below the AOE criteria, and would be cost effective. The two other exceptions are along the I-90 C/D, where barrier heights of 3.0 meters (10 feet) were investigated. This height is estimated to provided the minimum feasible reduction of 7 dBA and reduced noise levels below the AOE criteria. These barriers are also cost effective.~~

Noise walls were investigated for heights up to 5 meters (16 feet). The effectiveness of proposed mitigation for the NSF and for the collector distributor system is shown in Tables 4-14 and 4-15.

	Land Use(1)		Road	Existing Noise Levels	Noise levels, dBA, At 60 meters (200 feet) From Centerline for Build Alternatives Year 2020 Wall Height meters (feet)			
Freeway Segments With Proposed Mitigation	**West**	**East**	**Type(2)**	**dBA**	**No Wall**	**3.7 (12)**	**4.3 (14)**	**5.0 (16)**
Market/Greene Alternative South Option								
Trent-Mission Interchange to Grace Avenue	R	R,S	EV	58-68	69	64	64	63
Grace Avenue to Wellesley Avenue	C	R,V	DP	50-58	72	64	64	62
Francis to Lincoln Road	V,R	V,R	EV	50-55	72	65	64	64
US 2 to US 395	R	R	EV	45-50	69	63	62	62
Market/Greene Alternative North Option								
Trent-Mission Interchange to Grace Street	R	R,S	EV	58-68	69	64	64	63
Grace Avenue to Wellesley Avenue	C	R,V	DP	50-58	72	64	64	62
Francis to Lincoln Road	V,R	V,R	EV	50-55	71	65	64	63
Stoneman Road to US 2 (Mead Mobile Home Park)	V	R	EV	50-55	71	65	64	64
US 2 to US 395	S,V	R	EV	45-50	69	63	62	62
Havana Alternative With South Option								
Trent-Mission Interchange to Euclid	V,R	I	EV	55-60	70	63	62	62
Euclid to Wellesley Avenue	R,P	I,P	AG	54-61	74	65	64	63
Francis to Lincoln Road	V,R	V,R	EV	50-55	73	66	65	64
US 2 to US 395 (Near US 395)	R	R	EV	45-50	69	63	62	62
Havana Alternative With North Option								
Trent-Mission Interchange to Euclid	V,R	I	EV	55-60	70	63	62	62
Euclid to Wellesley Avenue	R,P	I,P	AG	54-61	74	65	64	63
Francis to Lincoln Road	V,R	V,R	EV	50-55	73	66	65	64
Stoneman Road to US 2 (Mead Mobile Home Park)	V	R	EV	45-50	71	65	64	64
US 2 to US 395 (Near US 2)	S,V	R	EV	45-50	69	63	62	62

NOTES:

1. Land Use Key R=Residential, I=Industrial, C-Commercial, P=Park or Recreation, S=School, V=Vacant
2. Roadway Types: AG=At-grade roadway, EVB=Elevated berm, DP=Depressed Roadway.

Summary of Sound Wall Effectiveness for the North Spokane Freeway
Table 4-14

I-90 C/D Segment With Proposed Mitigation	Roadway Type	Noise Levels for Design Year 2020 Predicted at 90 meters (300 feet) Land Use North & South	No Wall	With Wall	Wall Height Meters (feet)
Perry Street to Altamont Street	At grade Elevated berm	R R	70 71	63 64	3.7 (12) 3.0 (10)
Altamont Street to Regal Street	At grade Elevated berm	R R	70 71	63 64	3.7 (12) 3.0 (10)
Regal Street to Rebecca Street	At grade Depressed	R R	70 67	63 62	3.7 (12) 3.0 (10)
Rebecca Street to Florida Street	At grade Depressed	R R	70 67	63 62	3.7 (12) 3.0 (10)
Florida Street to Fancher Road	At grade Elevated berm	R R	70 71	63 64	3.7 (12) 3.0 (10)
NOTE: R= Resident					

Summary of Sound Wall Effectiveness for I-90 Collector/Distributor System

Table 4-15

Results are shown for the wall heights that would provide the required 7 dBA reduction. Also included are three cases where an excellent cost to benefit ratio has resulted in a recommended wall without the 7 dBA reduction. However, not all of the areas where the 7 dBA reduction is achieved are recommended for wall construction because the cost per mitigated impact is too high.

A summary of the benefits and costs of sound walls is summarized in Tables 4-16 and 4-17. Points at a distance of 60 meters (200 feet) from the centerline of the roadway along the proposed freeway alignments have been analyzed for each freeway segment. This distance is representative of close receptors. For the analysis along the I-90 C/D system, a distance of 90 meters (300 feet) was used, because 60 meters (200 feet) is within the proposed right of way.

For the Market/Greene Alternative with South Option, noise barriers of 3.7 to 5.0 meters (12 to 16 feet) would eliminate all impacts to areas where detailed mitigation measures were investigated. The Pine Acres Golf Course would be displaced. No mitigation was proposed for the new location of the golf course, because a location has not been determined. Three of the seven barriers investigated are recommended. These three stand 3.7 meters (12 feet) high and span a total of 3,000 meters (9,600 feet). The estimated cost is $1,675,000, with 210 residences receiving benefit. For the Market/Greene Alternative with North Option, the same three barriers are recommended and provide the same results. In addition, a 4.3x370 meter (14x1200 feet) barrier is recommended for the Mead Mobile Home park. The total cost for the Market Greene Alternative with North Option is $1,929,000, with a total of 235 residences receiving benefit. Recommended barriers are shown in bold print in Table 4-16.

Freeway Segment	Side of Road	Proposed Wall Meters (feet) Height	Length	Residential Summary Estim-ated Cost $1000	Receiv-ing Reduc tion	Cost in $ per Resid-ence	Additional Sensitive Receptors Receiving Benefit
Market/Greene With South Option		**TOTALS=>**	5,400 (17,600)	3,471	320		
Trent-Mission I/C to Grace Avenue	**West**	**3.7 (12)**	**1,000 (3200)**	**608**	**100**	**6,100**	
	East	**3.7 (12)**	**700 (2200)**	**425**	**70**	**6,100**	
Grace Ave. to Wellesley Ave.	**East**	**3.7 (12)**	**1,300 (4200)**	**642**	**70**	**9,200**	Wild Horse Park
Francis to Lincoln Road	West	5.0 (16)	450 (1500)	360	10	36,000	
	East	5.0 (16)	850 (2800)	680	30	22,700	
US 2 to US 395	West	4.3 (14)	550 (1800)	378	20	18,900	
	East	4.3 (14)	550 (1800)	378	20	18,900	
Market/Greene With North Option		**TOTAL =>**	5,550 (18,000)	3,428	320		
Trent-Mission I/C to Grace Avenue	**West**	**3.7 (12)**	**1,000 (3200)**	**608**	**100**	**6,100**	
	East	**3.7 (12)**	**700 (2200)**	**425**	**70**	**6,100**	
Grace Ave. to Wellesley Ave.	**East**	**3.7 (12)**	**1,300 (4200)**	**642**	**70**	**9,200**	Wild Horse Park
Francis to Lincoln Road	West	4.3 (14)	450 (1500)	309	10	30,900	
	East	4.3 (14)	850 (2800)	585	30	19,500	
Stone Road to US 2 (Mead Mobile)	**East**	**4.3 (14)**	**370 (1200)**	**254**	**25**	**10,100**	
US 2 to US 395	West	4.3 (14)	800 (2600)	550	15	36,700	
Havana With South Option		**TOTAL =>**	4,450 (14,500)	2,991	195		
Trent-Mission I/C to Euclid	**West**	**3.7 (12)**	**1000 (3200)**	**608**	**80**	**7,600**	Minnehaha Park
Euclid to Wellesley Ave.	West	4.3 (14)	500 (1600)	280	20	14,000	Esmeralda Golf Course
	East	4.3 (14)	550 (1800)	307	15	20,500	
Francis to Lincoln Road	West	5.0 (16)	450 (1500)	360	10	36,000	
	East	5.0 (16)	850 (2800)	680	30	22,700	
US 2 to US 395	West	4.3 (14)	550 (1800)	378	20	18,900	
	East	4.3 (14)	550 (1800)	378	20	18,900	
Havana With North Option		**TOTAL =>**	**4,600 (15,000)**	**3,094**	**195**		
Trent-Mission I/C to Esmeralda GC	**West**	**3.7 (12)**	**1000 (3200)**	**608**	**80**	**7,600**	Minnehaha Park
Esmeralda GC to Wellesley Ave.	West	4.3 (14)	500 (1600)	280	20	14,000	Esmeralda Golf Course
	East	4.3 (14)	550 (1800)	307	15	20,500	
Francis to Lincoln Road	West	5.0 (16)	450 (1500)	360	10	36,000	
	East	5.0 (16)	850 (2800)	680	30	22,700	
Stone Road to US 2 (Mead MHP)	**East**	**4.3 (14)**	**370 (1200)**	**254**	**25**	**10,200**	
US 2 to US 395	West	4.3 (14)	800 (2600)	550	15	36,700	

NOTES:

1. Bold type indicates recommended barrier.
2. GC=Golf Course, MHP=Mobile Home Park.

Freeway Segment	Total Impacts (refer to table 4-12)	Total Reductions
Market/Greene With South Option	215	240
Market/Greene With North Option	210	265
Havana With South Option	170	80
Havana With North Option	165	105

Comparison of Impacts to Mitigated Impacts (Reductions) for "cost effective" barriers measured in number of residences.
Some residences receive benefits that were not measured as impacted by noise analysis.

Summary of Noise Mitigation for the North Spokane Freeway

Table 4-16

Of the seven barriers investigated for the Havana Alternative with South Option, only one was found to be reasonable. This barrier would stand 3.7 meters (12 feet) high and span 1000 meters (3200 feet), giving protection to 80 residences and costing approximately $608,000. The Pine Acres Golf Course would be displaced. No mitigation was proposed for the new location of the golf course, because a location has not been determined. The barrier recommended for the Mead Mobile Home Park in the Market/Greene Alternative is also recommended for the Havana Alternative with North Option. The total cost of recommended mitigation for this option is estimated at $862,000, with 105 residents receiving benefit. Recommended barriers are shown in bold print in Table 4-16.

All 10 barriers investigated along the I-90 C/D are recommended. The total cost of these barriers is estimated at $4,610,000, with 710 residences receiving benefit. There are a total of 8590 meters (28,000 feet) of barrier at these locations. Recommended barriers are shown in bold print in Table 4-17.

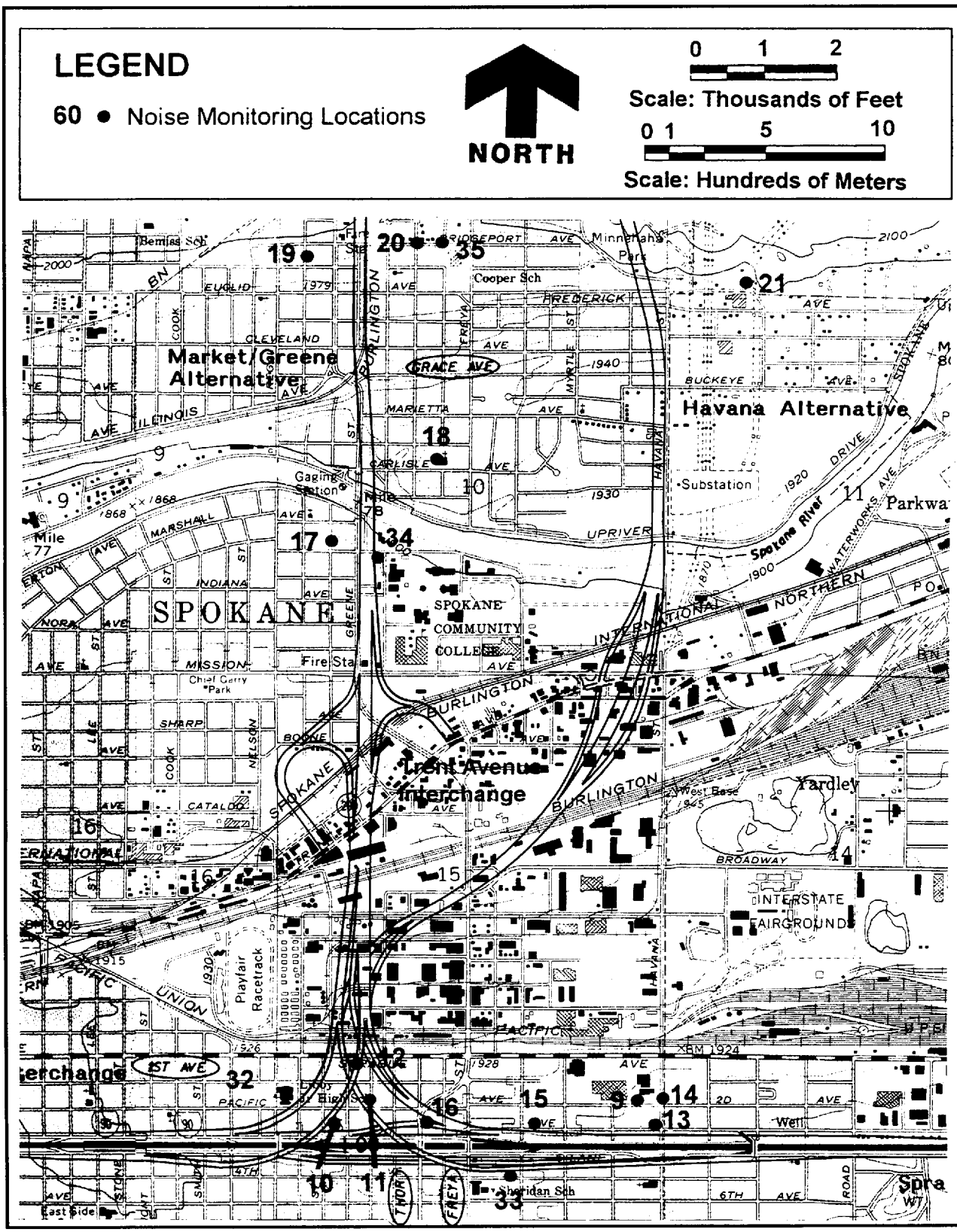
Impact Remaining after Proposed Mitigation

Even with the recommended mitigation, more than 55 impacts will remain for the Market Greene Alternative with South Option, and more than 40 impacts will remain with the North Option of this alternative. The Havana option will have over 80 impacts remaining with the South Option and 65 with the North Option.

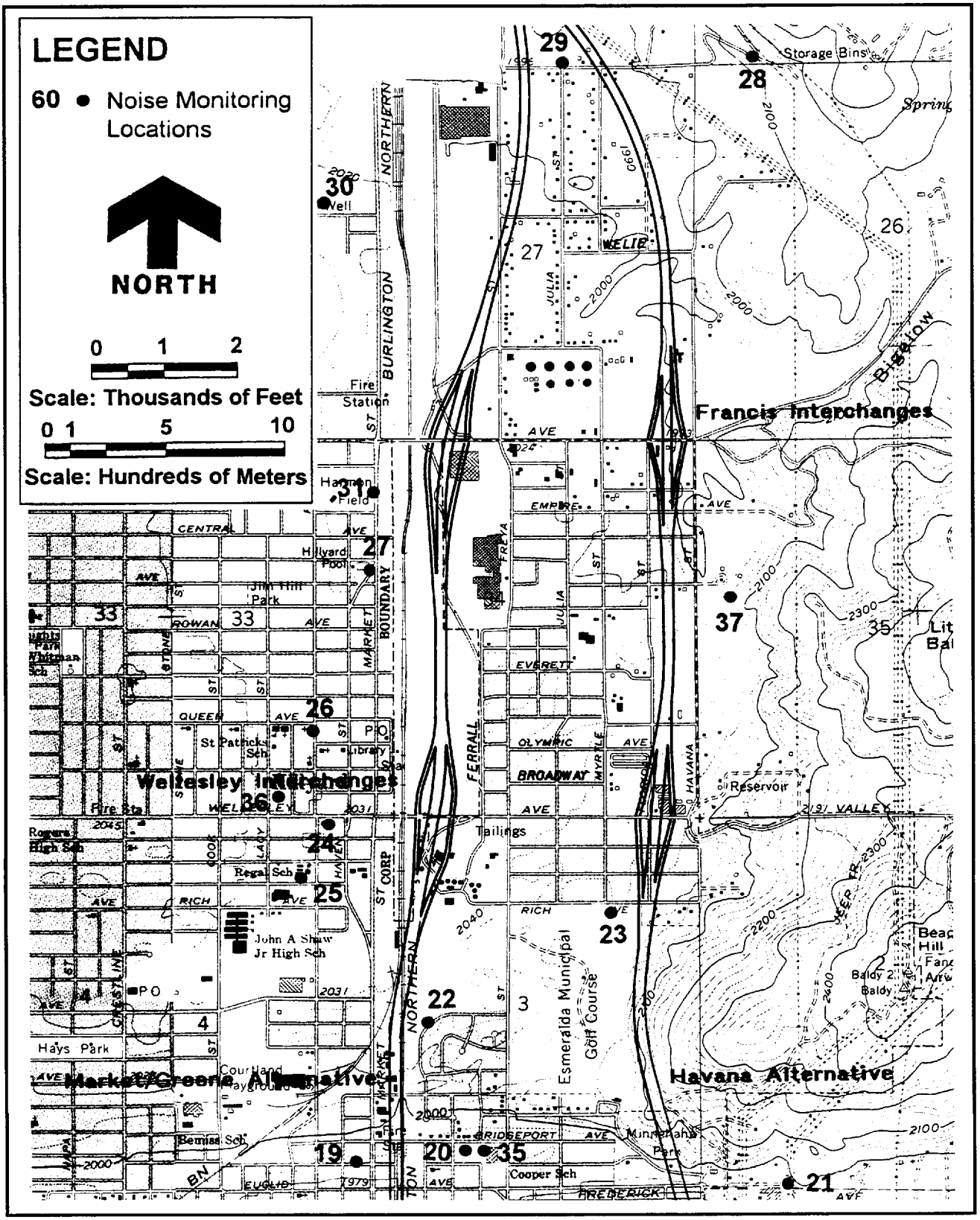
I-90 C/D Segment	Side of I-90	Proposed Wall meters (ft.) Height	Length	Est. Cost ($1000)	Resident. Cost Summary Receiving Reduc.	Cost in $ per Resid-ence	Other Impacted Noise Sensitive Receptors Receiving Benefit
Perry Street to Altamont Street	north	3.7 (12)	1100 (3,600)	668	120	5,600	0
	south	3.0 (10)	980 (3,200)	470	50	9,400	East Side Youth
							Center Liberty Park
Altamont Street to Regal Street	north	3.7 (12)	550 (1,800)	334	60	5,600	Libby Center *
							Your Place Park
	south	3.0 (10)	500 (1,600)	240	60	4,000	0
Regal Street to Rebecca Street	north	3.7 (12)	610 (2,000)	370	50	7,400	0
	south	3.0 (10)	1100 (3,600)	528	90	5,900	Sheridan School
Rebecca Street to Florida Street	north	3.7 (12)	400 (1,300)	243	50	4,900	0
	south	3.0 (10)	400 (1,300)	192	60	3,200	0
Florida Street to Fancher Road	north	3.7 (12)	1170 (3,800)	711	80	8,900	0
	south	3.0 (10)	1780 (5,800)	854	90	9,500	0
		TOTALS >	**8590 (28000)**	**4610**	**710**		

NOTES: All 10 barriers along I-90 and I-90 C/D are recommended. There are 225 residences receiving benefit that were not considered impacted by measurements from noise analyses. (refer Table 4-13)
~~Libby Middle School (Libby Center) was closed as a school after the 1993-94 school year.~~

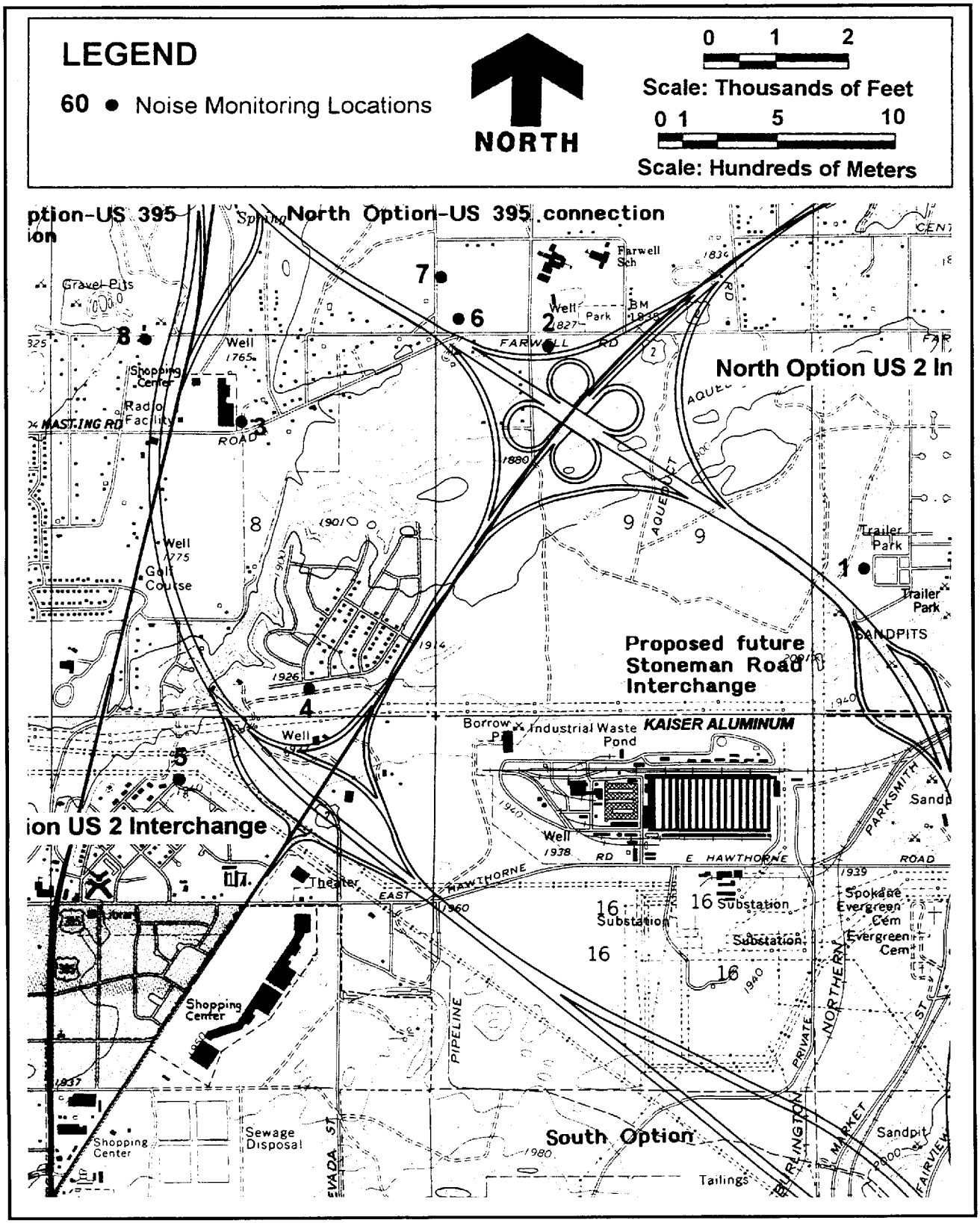
Summary of I-90 and I-90 C/D Noise Mitigation Analysis
Table 4-17



Market/Greene (Preferred Alternative) and Havana Alternative Final Study Routes and Noise Monitoring Locations — Area 1
Figure 4-2



Market/Greene (Preferred Alternative) and Havana Alternative Final Study Routes and Noise Monitoring Locations — Area 2
Figure 4-3



North Option (Preferred Alternative) and South Option
Final Study Routes and Noise Monitoring Locations — Area 3
Figure 4-4